QUARTERLY

LOS ANGELES COUNTY MUSEUM

Published by the MUSEUM ASSOCIATION of the LOS ANGELES COUNTY MUSEUM

SUMMER, 1946 VOL. 5, NO. 2

Cinnamon Teal. Water color by Lynn Bogue Hunt.

Courtesy of Cooper Ornithological Club

George Willett

1879-1945

George Willett attained distinction in the fields of ornithology, mammalogy, invertebrate paleontology and conchology. His publications will stand as an enduring monument to his genius.

His attainments were in no small measure due to the sterling character of the man himself. Worth-while friends were drawn to him as is iron to a magnet. Because he gave so generously of himself, he received largely of the wisdom of his many confreres.

George Willett was born in Hawkesbury, Ontario, Canada, May 28th, 1879, and died in Los Angeles August 2nd, 1945. He held many responsible posts before joining the Los Angeles Museum Staff in 1927. He served as head of the division of Ornithology from 1928 to the day of his death.

Science in general and the Los Angeles County Museum in particular have profited greatly through the work of George Willett. The standards he established have set a precedent that calls for the highest attainments in his associates and successors.

John A. Comstock

MIGRATION OF NORTH AMERICAN BIRDS*

By George Willett

Among all the phases of the study of birds, perhaps the most fascinating to the student is that of migration, the complexity of the subject undoubtedly adding much to its interest. Indeed, there are so many angles to this subject that few of the very numerous books and papers written about it agree in all particulars. Mr. W. L. McAtee, of the United States Fish and Wildlife Service, says in a recent publication: "The human mind is prone to query 'Why?' but usually is not critical enough of its answers to that question. Postulated causes of migration are as numerous as alleged remedies for an incurable disease and scarcely more impressive. Probably numerous factors are involved, but in divining them it should not be forgotten that most migrational phenomena are of very ancient origin. To ascertain their cause in any direct way is, therefore, impossible. In time each cause may have been modified so as to be no longer traceable. As is the case with most scientific speculation, we find in the realm of migrational phenomena that what appears satisfactory in one case must be rejected in another. A reason acceptable for southward, cannot apply to northward, migration; the urge for a bird starting to move in the middle of summer cannot be the same as for one that waits until frost; the motivation of a species that goes to the Antarctic hardly coincides with that of one that seeks the tropics; and so on. One comparatively recent treatise on the subject was given the very descriptive title: 'The Riddle of Migration,' and that book as well as other works on migration have left cause still a riddle."

For millions of years the process of continual change in animals, and their habits, has been going on under every conceivable condition and with countless ramifications. Whole families, and even orders of animals have appeared, gone through their changes, and ceased to exist. The branches of the animal tree have spread in a multitude of directions, progressing at some points and retrogressing at others, diverging here and interlocking there. The causes and exact nature of a great majority of these changes are buried in the dim and distant past.

In such manner has come the development, not only of the animals themselves, but of their habits, including migration. Is it to be wondered at, then, that any effort to explain all phases of migration is doomed to failure before it is started? The knowledge that scientists have about the past history of this subject is infinitesimal in comparison to what they do not know and never will know about it.

A late dictionary defines migration as "changing place of abode, especially from one country or climate to another." The knowledge of such movements by the birds is very ancient, going back for more than 3500 years. Holy Writ tells us that the arrival of a migration of quails saved the Israelites from starvation in the wilderness of Sinai. Biblical students have fixed the date of this occurrence as about the year 1580 B.C. The prophet Jeremiah (probably about 625 B.C.) wrote that "The stork in the heavens knoweth his appointed time; and the turtle dove and the crane and the swallow observe the time of

*This paper was prepared as a lecture, in 1940, on the occasion of the opening of the Museum exhibit, "Birds of Passage." The data in it have been kept up to date, and the manuscript used frequently by Mr. Willett in classwork for bird students.

their coming." The Greek poet Anacreon, in the fifth century B.C., speaking of the swallow, accurately referred to its winter home in Egypt thus:

> But when the chilling winter lowers,
> Again thou seek'st the genial bowers
> Of Memphis, or the shores of Nile,
> Where sunny hours forever smile.

Aristotle, naturalist and philosopher of ancient Greece, wrote: "Some creatures can make provisions against change without stirring from their ordinary haunts; others migrate, quitting the cold countries to avoid approaching winter, and after the spring equinox migrating from warm lands to cool lands to avoid the coming heat. In some places they migrate from places near at hand; in others they may be said to come from the ends of the world, as in the case of the Crane, for these birds migrate from the steppes of Scythia to the marsh lands of Egypt, where the Nile has its source." While many of the statements of Aristotle show keen perception of some facts regarding bird migration, he made the error of giving credence to the fallacious idea of the hibernation of birds. According to this superstition, some species of birds were able to suspend their vital processes and pass the cold period in a torpid state, hidden in hollow trees or caves, or even buried in the mud of marshes. This idea was so strong that it survived for more than 2000 years and was accepted by such distinguished 18th century naturalists as Linnaeus, Buffon, Cuvier and Gilbert White. It was learnedly discussed before such distinguished bodies as the French Academy of Sciences and the Royal Society of England. Even in our own time this theory was advanced as explaining the absence in winter of the Chimney Swift, which was believed to migrate southward to the Gulf of Mexico in fall and bury itself in the mud until spring. We now know that this bird flies across the Gulf to its winter home in South America.

Another fallacy of migration which dies hard is the theory that some of the smaller birds hitch-hike a ride on the backs of the larger ones. This idea probably arose mainly from the fact that, while the larger birds are much in evidence during their travels, many of the smaller ones are inconspicuous, both because of their small size and their habit of night-migration. While in Alaska, I found the belief general among the natives that the Rufous Hummingbird rode into the country in spring on the backs of geese. No explanation was given, however, as to how the smaller birds return south in the fall, as they leave the country some time before the geese do.

As, with the possible exception of some of the penguins, all migrations of birds are made through the air, it may be pertinent to consider briefly the powers of flight possessed by birds, which we humans are attempting to imitate. A bird's feathers are not only good insulators against cold and heat, but also, in certain of their forms, are surprisingly strong. In fact, the extreme lightness and strength of the flight feathers, coupled with their elasticity, produce the perfect material for a machine designed for aerial navigation. Furthermore, the ability of the bird to control the separation of the tips of the primary feathers permits adjustment to varying air pressures by allowing surplus air to slip between the feathers.

Our present knowledge indicates that the speed of bird flight has been generally exaggerated, both by sportsmen and by many students. While undoubtedly there are birds capable of attaining speeds of sixty miles an hour or better, it may be safely stated that these cases are decidedly in the minority. Speed of birds estimated by an observer on the ground is unsatisfactory, as the wind currents should be taken into consideration. Much less liable to error are estimates made from aircraft, since birds and airships are equally affected by the wind. Since air travel by man has become general, considerable data on the speed of birds has accumulated.

Observations indicate that ducks and geese have a normal flight speed of between forty and fifty miles per hour. Aviators state that, with a speed of 65 miles, they can easily overtake ducks, in spite of the apparent efforts of the birds to maintain their lead. Most hawks, herons, ravens, shrikes and horned larks are found to fly only 15 to 34 miles per hour, while among the smaller birds, many make only from 10 to 20 miles per hour. Even the Mourning Dove, with a reputation as a speedster, rarely flies faster than 35 miles. Swallows, as a group, normally fly at from 24 to 31 miles per hour, although on occasions they may accelerate to 46 miles. The diminutive hummingbird with its remarkably fast wing-beat of approximately 200 strokes per second is easily capable of a speed of from 45 to 55 miles an hour. Frederick Lincoln states that the slowest flight recorded to date is that of a woodcock that maintained itself in the air at a speed of only five miles per hour.

We frequently hear of alleged excessive speed of homing pigeons, but records by pigeon-racing clubs, as well as of birds used by the army during the World War, show that a bird that does 60 miles per hour is exceptional. The greatest bird speeds that have been reliably recorded are of Swifts and Duck Hawks. There is one record of Swifts that flew circles around a plane travelling at 68 miles per hour, to do which the birds must have attained a speed of approximately a hundred miles per hour. The Peregrine Falcon, or Duck Hawk, is probably the fastest bird. One timed with a stop watch, during an aerial dive in pursuit of its quarry, was estimated to have reached a velocity of 165 to 180 miles. To summarize, while there are exceptional instances of high speed attained by some species, the normal rate of even the faster birds is usually from 30 to 50 miles per hour. Probably most species perform their migrations at even slower speeds. Sustained flight of ten hours a day would carry some of the slower birds less than 200 miles, while ducks and geese might travel as far as 400 to 500 miles in the same length of time. However, it must be remembered that most birds during the southward migration proceed leisurely, stopping frequently for varying periods of time to obtain food. My observations on migrating water birds off San Pedro indicate that, while the fall migration is a leisurely one, the general movement in spring is much more hurried. At this time many species continue their flight throughout the night hours.

While, as already stated, study of bird migration began many centuries ago, until the last few years our knowledge of the subject must be considered only a general one. However, since the beginning of bird-banding, which was begun systematically in Europe in 1899, and in America about ten years later, we have learned much that was previously unknown. By this method of placing numbered bands on the legs of birds trapped in many localities during all seasons of the year, as well as by banding young birds before they leave the nests, it is possible to obtain much exact information. While it is true that a large percentage of banded birds are never heard of again, the fact that more than 300,000 individuals are marked each year insures enough returns to furnish an increasing amount of concrete information regarding the birds' movements. Unfortunately the results obtained from bird-banding have been less tangible here in the west than they have in the east. This is not only because we have fewer banding stations, but because many of our western birds migrate over courses where there is little likelihood of their being encountered by persons sufficiently interested to return the bands.

From information obtained by banding, we are able to learn, not only the general course of the migration of many species of birds, but the amount of time consumed on their journeys. The Canada Goose, for instance, begins its exodus from the southern United States in February and proceeds northward leisurely, keeping pace with the advance of spring, and not reaching Alaska and Labrador until the last of April. On the other hand the Gray-cheeked Thrush, on its way northward from South America, leaves southern United States the last of April and reaches northern Alaska by May 25, thus making practically the same journey in less than half the time taken by the larger bird.

We know that night migration is very common, but the assumption that birds that migrate at night come to the earth in the daytime seems to be unfounded. In this regard, Mr. McAtee says: "The calls of migrants heard throughout the hours of darkness, but ceasing with the dawn, pose another question. It is tacitly assumed, I believe, that when we no longer hear the birds, it is because they have alighted. This, however, is manifestly not true of the geese, and may not be of others. They may keep on going at the same height silently, or at greater elevation, out of hearing. If the stopover hypothesis were correct, on a morning after hearing migrants in apparent swarms, we should expect to find the countryside alive with birds, but how rarely do we have that experience . . . Referring especially to Washington, D.C., where I have made most of my observations for years, one may hear birds passing over in large numbers practically every night in September, yet birds in the landscape are in that month at the lowest ebb of the year."

The routes followed by migratory birds are numerous; some are simple and easily traced, and others extremely complicated. While, in the main, they proceed in a southerly direction in the fall and north in the spring, there are many exceptions to this rule. Some species travel considerable distances easterly or westerly before finally heading north or south. A few species here on the west coast (to be mentioned later) may be said to migrate in exact opposition to the general rule. There are also some species of oceanic birds, such as albatrosses and shearwaters, that spread out over the ocean in an apparently irregular movement, the pattern of which is probably governed by the changing location of their food supply.

When such variations of migration routes are taken into consideration, it is not strange that very different theories have been advanced to explain the origin of these routes. One such theory, much in favor a few years ago, was that many species of birds originated in high latitudes in a milder climate than is found there at present. They were then supposed to have been driven southward by the formation of the Arctic ice pack, and then again moved northward with the recession of the ice. The supporters of this idea believed that present migration routes are those followed by the birds when retreating before the ice pack and advancing with it. Another theory, probably nearer to the truth, is that most birds originated in tropical regions and, as the number of species and individuals increased, there was a continual expansion into unoccupied territory. Finally some species were forced so far northward that they could only maintain themselves during the summer season, consequently were obliged to return south in the fall. This may, indeed, account for the migration of some of our birds, but it can hardly apply to all of them. Undoubtedly the primary causes for all bird migration are search for food and a satisfactory nesting locality. While the young are being raised, an unusually large supply of food is necessary, and this is more readily obtained by the moving northward of some species to a region where food is plentiful and competition at a minimum. Later, as the winter season approaches, food becomes scarce and many species are able to survive only by returning to a more temperate clime. In nearly every part of the world are found both migratory and non-migratory birds. While we are unable to prove conclusively why one species should migrate and a similar one should not, it may be safe to assume that the resident birds are the ones best able to withstand competition.

Regardless of the manner in which migration routes were originally established, they appear to be of very ancient origin. One bird that helps to prove this is the well-known Bobolink. Summer colonies of this bird, originally confined to eastern United States and Canada, have established themselves in several areas westward to eastern Oregon. Apparently, however, the migration route from these western outposts is not southeast to the winter range in South America, but directly east to a junction with the main migration route of the species.

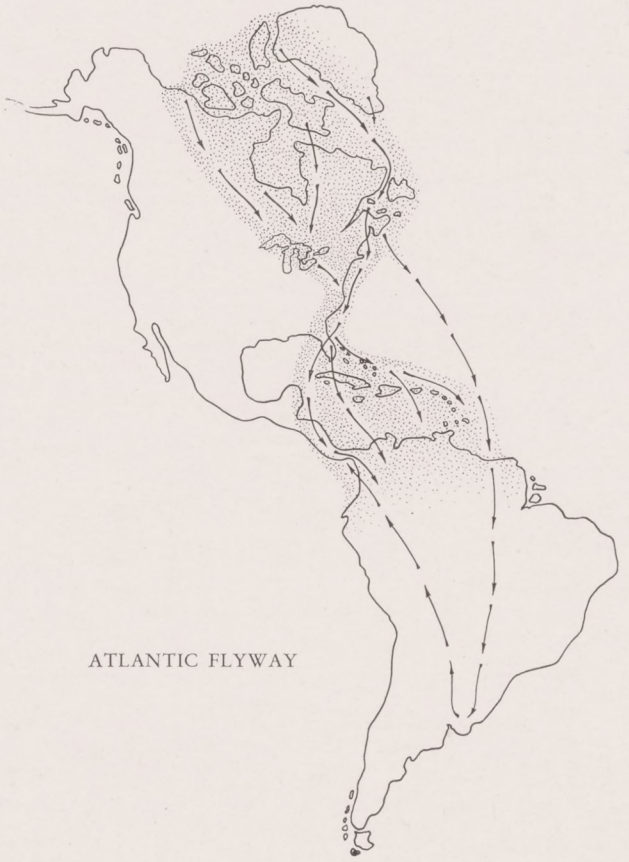
Although there are numerous exceptions, it may be generally stated that birds that cross North America from north to south, or vice-versa, use four main flyways, the courses

of which are probably largely governed by the direction of mountain ranges and river valleys. These flyways are usually referred to as the Atlantic, Mississippi, Central and Pacific. The species that use the Atlantic Flyway come from as far west as Alberta and as far east as Greenland and Labrador. Their routes converge on the coast of Virginia and the Carolinas and continue in a narrow belt to the peninsula of Florida. Here there is a divergence: some species, the Scarlet Tanager for example, cross the Gulf of Mexico to Yucatan and Honduras and continue through Central America and the Isthmus of Panama to South America; others, like the Bobolink, fly to Cuba and Jamaica, and then make a 500-mile crossing of the Caribbean Sea to the shores of Venezuela.

Many species that breed in Arctic regions, from the Mackenzie Delta on the west to Hudson Bay and Ungava on the east, gather into the Mississippi Flyway, which is narrowest in the Mississippi Valley in Arkansas and Louisiana. This route is perhaps the most important of all routes for migratory waterfowl. It is used by countless thousands of Mallards, Pintails, Ring-necked Ducks, Lesser Scaups, Canada Geese, and various other species. While many of these birds winter in southern United States, numerous land birds, including the Rose-breasted Grosbeak and several species of warblers, cross the Gulf of Mexico to Central and South America. A route that joins the main artery of the Mississippi Flyway on its eastern side is that of the Blue Goose. These birds proceed south from their breeding grounds on Baffin and Southampton islands to Hudson and James bays, from which they usually take off on a nonstop flight to their wintering grounds in the marshes of Louisiana. This is probably the most direct north-south course followed by any North American birds. On their return flight in the spring there is a tendency to swerve westward, and at this time they are occasionally abundant in eastern South Dakota and southeastern Manitoba.

The Central Flyway is of much more uniform width than either of the two previously discussed. In the north it extends from Northeastern Alaska to Victoria Land and central Mackenzie, and in the United States it is bounded generally by the Mississippi River on the east and the Rocky Mountains on the west. In western Montana, however, it crosses the continental divide, proceeding through the Great Salt Lake Valley and southward crossing the tablelands of Mexico to Central and South America. This is apparently the only flyway where all migration is overland. Along this route come ducks that in the north country share breeding grounds with others that in migration follow all of the other flyways. On the western boundary of the Central Flyway lie the Bear River Marshes of Utah, the most important single breeding area for waterfowl now remaining in the United States. In this area are reared thousands of Pintails, Redheads, Reals and other ducks, Canada Geese and shore birds of various species. From records made on banded birds, the routes from the Bear River Marshes have now been well charted. It is found that a large percentage of the ducks from these marshes migrate westward to the Pacific Flyway. At least three routes, however, leave the area in an easterly direction, two of which go down the Central Flyway to Mexico, and the third, apparently used only by Redheads, extends easterly to New York, Maryland and Virginia. One of the interesting land birds using this flyway is the Harris Sparrow, which breeds in northern Canada from Great Bear Lake to the shores of Hudson Bay. When these birds begin their fall migration, their travel necessarily covers the full width of their breeding range, but their route to the southward gradually narrows to a width of about 500 miles in the area across North Dakota and the western half of Minnesota. Their winter range, which is from Nebraska and Missouri south to Texas, is in places only about 150 miles in width.

The Pacific Flyway, as its name implies, embraces that part of the North American Continent bordering the Pacific Ocean. It is widest in the north, where it extends from the Aleutian Chain to Victoria and Banks islands. In the United States it extends from the Pacific to the eastern border of the Rockies. Although the movements of some of the birds using this flyway are rather well known, definite information regarding others—



ATLANTIC FLYWAY

PACIFIC FLYWAY

After Lincoln, "The Migration of American Birds"

Drawn by Gearhard Bakker.

MISSISSIPPI FLYWAY

CENTRAL FLYWAY

After Lincoln, "The Migration of American Birds"

Drawn by Gearhard Bakker.

particularly those that migrate over the ocean—is still rather scanty. From observations of ducks, gulls, and other water birds passing the Arctic coast, it appears that the best defined Arctic route in North America is that along the north coast of Alaska, down the west coast and across the Alaska Peninsula and Gulf of Alaska to the coast of British Columbia. From the time it reaches northern California this flyway gradually contracts as it follows down the west coast of Mexico and merges with the Central Flyway in Central America and Panama. Along this coastal route come the Cackling Goose, Black Brant, and Surf and White-winged scoters. The first of these species winters principally in northern and central California, but the winter range of the others extends well down the Lower California coast. Another well-defined migration route extends down the east side of the Pacific Flyway. This is used by hordes of waterfowl raised in eastern Alaska and the Mackenzie Delta, and also by numerous land birds. This route extends almost directly south through western Alberta, closely paralleling the eastern foothills of the Rocky Mountains; near the United States border it branches, part of the flight going southeastward into the Central Flyway, and the other part veering to the west to the marshes of Oregon and California. This flight furnishes a large percentage of California's winter waterfowl.

Forking into the eastern edge of the Pacific Flyway is the route followed by the little Ross Goose, whose breeding ground, only recently discovered, is on the Arctic Coast of Canada, south of Victoria Island. In fall these birds migrate by way of the eastern part of Great Slave Lake and Lake Athabasca, joining hordes of other waterfowl bound for the east coast of the United States and the Gulf of Mexico. However, when a point near the northern boundary of Montana is reached, the Ross Geese separate from their companions and proceed southwest across the Rocky Mountains to California. Forty years ago this bird was an abundant winter visitant to our interior valleys, where it was shot in large numbers by market hunters. It still visits California, at least the northern part of the state, but in greatly reduced numbers. Many of the Redheads shot by California hunters are raised in the Bear River Marshes of Utah. Banding records indicate for these birds two routes, one crossing southwestern Idaho and southeastern Oregon and entering our state near the California-Nevada line, the other coming through central Nevada and reaching the interior of California near the junction of the Sacramento and San Joaquin rivers.

The southward-moving land birds of the Pacific Flyway, for the most part, migrate down the interior of California to the mouth of the Colorado River and thence to winter ranges that are chiefly in western Mexico. Among these birds may be mentioned the Western Tanager, which nests in the mountains from the Pacific coast east to Colorado and western Texas, and north into Canada. Apparently its winter home is in two different areas, one in southern Lower California and the other in southeastern Mexico and Guatemala. In the spring the Western Tanagers migrating up the coastal region appear to travel considerably faster than those coming up further inland. When the westernmost flight has reached northern Washington, the more eastern birds have progressed no farther than southern Colorado. Towards the end of May, at which time the Colorado birds reach their summer home in the northern part of that state, another contingent of the species has arrived on its breeding range in central Alberta, the latter apparently having travelled up the coast and across British Columbia and the snow-clad Canadian Rockies.

We might now consider the migrations of some birds which, by reason of distances travelled or other unusual features, are of especial interest. The longest migration known is undoubtedly that made by the eastern contingent of the Arctic Terns. This bird, which breeds in circumboreal regions of both hemispheres, in America summers from New England and Labrador to southeastern Alaska and north as far as land exists. A downy chick in a nest surrounded by snow was found within 500 miles of the North Pole. It is believed that the Arctic Terns of eastern North America originally reached this continent

from the Old World, possibly by way of Iceland and Greenland. Presumably on account of this origin, their fall migration route, instead of proceeding south along our Atlantic coast, goes eastward across the Atlantic to the shores of Europe and Africa, thence to extreme southern South America and even to Antarctica. The extreme summer and winter homes of these birds are 11,000 miles apart, and, when the circuitous nature of their migration route is considered, some individuals must fly at least 25,000 miles each year. We do not have as much data on the migration of the western part of this species, but it is known to proceed down the Pacific coast of the Americas. I have taken specimens in fall on the ocean off southeastern Alaska and also off southern California. James L. Peters, an eminent authority on the distribution of birds, states that the winter range of this tern is: "Antarctic Ocean, south to latitude 74°S.," but we do not know whether our Pacific birds mingle with their Atlantic relatives at that season. Probably the Arctic Tern experiences more daylight hours than any other living creature. In the northern part of the range of this species the sun never sets during the nesting season, and in the winter home in the south the same situation prevails. There appears to be little definite information regarding the northward journey of this bird in the spring. It is probably more hurried than the fall movement and almost entirely over the ocean.

An examination of the slender body and long wings and tail of the Arctic Tern might lead one to conclude that these structural characters had some connection with its very long migration. However, when we note the great similarity between this bird and the Common and Forster terns, which make comparatively short migrations, the idea does not seem worthy of much consideration.

The members of the Order Procellariiformes, which consists of albatrosses, fulmars, shearwaters and petrels, spend all of their lives on the water except for the relatively short time when they are nesting, usually on remote islands of the ocean. We know very little about exact routes of migration of these birds. It is entirely possible that their movements do not follow definite courses, but are more in the nature of wide-spread wanderings in search of food, and in return from widely separated points to the breeding grounds. One member of this group that is known to cover great distances, probably almost as great as do some of the western Arctic Terns, is the Slender-billed Shearwater. The breeding grounds of this bird are on islands off the southeast coast of Australia, where they nest during our winter season, and I have seen them in large numbers in Bering Sea at other times of the year. They have even been recorded as far north as Point Barrow. Three other species of shearwaters, the Sooty, Pink-footed and Black-vented, are common along our southern California coast at some seasons of the year. The first of these, the Sooty Shearwater, also ranges widely, breeding in New Zealand and on the west coast of Chile, and wandering northward in the Pacific to Alaska and Kamchatka, and in the Atlantic to Labrador and Greenland. The Pink-footed Shearwater breeds on the Juan Fernandez Islands, off Chile, and ranges north to southeastern Alaska. The Black-vented Shearwater apparently covers less territory than any of its previously mentioned relatives, breeding on islands off Lower California and travelling up our coast as far as British Columbia.

The Black-footed Albatross, our only common representative of the family Diomedeidae, breeds on islands in the central Pacific and ranges over most of that ocean north of the equator. It seldom comes very close to our shores, but is irregularly common fifty miles or more at sea.

Many members of the great group of shore-birds make extended migrations; in fact, there are known to be at least 19 species that nest north of the Arctic Circle and winter in South America. Six of these travel as far as Patagonia, thus having a migration route of more than 8000 miles in length. At least three species of shore birds that nest in Alaska and eastern Siberia make long journeys over open water to islands in the Pacific. The Wandering Tattler summers in south-central Alaska and Yukon Territory and winters south to Ecuador and islands in the mid-Pacific, occasionally as far as Australia and New

Zealand. The Pacific Golden Plover travels from northeastern Siberia and western Alaska to the Hawaiian Islands, China, Malaysia and India. The Bristle-thighed Curlew, another bird summering in the north, winters on islands in the Pacific Ocean, from the Hawaiian to the Marshall, Gilbert and Society islands. I have taken many specimens of the last two species on small islands a few hundred miles west of the Hawaiians. To get to these and other insular localities regularly visited by them, the birds would have to cross about 1500 miles of open water. Whether this flight is made without stopping we, of course, do not know. The eastern Golden Plover has been seen swimming on the ocean, and the Pacific bird probably can do the same. I have seen no record of curlews or tattlers swimming deliberately, but they will do so if wing-tipped and dropped in the water. We know that birds frequently alight on floating logs or other drift and sometimes on ships; and on one occasion in mid-ocean, I saw a large flock of what I took to be shore-birds on the dead body of a whale.

In any discussion of the migration of North American birds, the eastern Golden Plover should be mentioned; first, because it uses entirely different routes in spring and fall, and, second, because most of the adults go south on one route and the young on another. Also, although its journeys are not quite as long as those of one or two other species already considered, they are far from being short. The summer home of this Golden Plover is on the Arctic American coast and islands from Hudson Bay to northern Alaska. In the fall most of the adult birds migrate southeast along the north coast of North America to Labrador and Nova Scotia, and then strike south over about 2400 miles of ocean to northern South America, flying both day and night. In fair weather some of these birds have been observed passing Bermuda and some of the Lesser Antilles without stopping. From the north coast of South America the plovers proceed south down the middle of the continent to the pampas of Argentina. Most of the immature birds leave the nesting grounds late in summer and go south through the Mississippi Valley and down the western part of South America to join the adults. In spring all the birds go north over about the same route that the young birds use in the fall, up the Mississippi Valley and across central Canada to the nesting grounds. Thus, the adult Golden Plover performs a round trip journey in the form of an enormous ellipse, about 2000 by 8000 miles across the axes. An almost identical journey was made by the now extinct, or nearly extinct, Eskimo Curlew; southeasterly from northern Mackenzie to New England, New York and New Jersey, thence across the sea to South America and to Argentina, Chile and the Falkland Islands; returning in spring by way of Texas, over the prairie regions, mainly west of the Mississippi River, and through Nebraska and central Canada to its summer home.

A somewhat similar flight, though on a lesser scale, is made by one of our small land birds, the Connecticut Warbler. When these little birds leave their nesting grounds, which lie mostly between the Great Lakes and Alberta, they fly a thousand miles almost due east to New England, then south to Florida and across the West Indies to Colombia, Venezuela and northern Brazil. In spring they return to Florida by approximately the same route, then instead of going up the Atlantic coast, they veer to the westward and follow up the Mississippi Valley to their summer home.

Some species of land birds that are more or less associated in North America in summer may make long migratory flights and occupy the same winter quarters. It is known that some Olive-backed Thrushes, swallows and nighthawks from the same area in northern Canada continue to be close neighbors on their wintering grounds in Brazil. Some individual Nighthawks and Barn Swallows travel still farther, going south to Argentina, probably 5000 miles from their summer home. This may be the longest migration made by any of our North American land birds.

It is a difficult matter to correlate migration very extensively with classification of birds, most families containing both migratory and non-migratory species. It may be stated further that some geographic races of a species may migrate, while other races of

the same species may remain throughout the year in the same territory. Even in birds of the same race, some individuals migrate while others do not. There are many species that desert the northern part of their range in autumn, but remain through the winter in the southern part. We are not yet sure whether, in instances of this kind, the northern birds cross over their more southern relatives, or whether they replace them, the latter moving south. Even though we may have a certain species of bird with us throughout the year, we are usually unable to tell whether or not the same individuals are present. These and many other similar questions can be answered only by extensive banding. Already, though banding in California is in its infancy, it has brought out some facts surprising to us older ornithologists who believed we knew a good deal about the movements of our local birds. Until a few years ago, I had believed that our House Finch, or Linnet, was strictly non-migratory and that one might live its entire life in a square mile or two; then a bird banded in southern California was recovered in Oregon. I had the same ideas about the Long-eared Owl, and a specimen banded in California was found up in Canada.

An interesting example of different migration habits in various races of the same species has been pointed out by the late Harry Swarth in his published study of the Fox Sparrows. Of the six recognized coastal races of this bird, four breed in the region of the Gulf of Alaska, one in southeastern Alaska and northern British Columbia, and the other in southern British Columbia and northern Washington. In fall the four northern-most races, the Shumagin, Kodiak, Valdez and Yakutat fox sparrows, cross over the ranges of the other two, the Townsend and Sooty fox sparrows, and winter to the south of them. Our local representative of this group, the Stephens Fox Sparrow, a common breeding bird in the mountains of southern California, above 6500 feet, leaves these mountains in the fall and proceeds to a winter range, undoubtedly somewhere southward but as yet unknown to ornithologists.

A few of our local birds apparently perform migrations exactly contrary to the general rule, in that they go north in fall and south in spring. Among these are the Large-billed Marsh Sparrow, which breeds at the head of the Gulf of California and winters north to central California, and the Heermann Gull, with nesting grounds on islands off the Mexican coast and winter range north along the Pacific coast as far as southern British Columbia. Also, we have the Craveri Murrelet, breeding in Mexican waters and wintering north as far as Monterey. However, as the distances covered by these contrary birds are comparatively short and without very striking climatic changes, they probably should not be regarded as outstanding exceptions to the general rule of migration.

A few remarks on the habits of our local birds, as regards migration, may be of interest. In southern California west of the mountains there are 345 kinds of birds that may be considered rather common, and about 100 more that have been known to occur as stragglers or very irregular visitants. Of the 345 regulars, there are 147 resident throughout the year, 51 summer visitants, 116 winter visitants, and 31 that occur only as migrants through the region.

LOS ANGELES COUNTY MUSEUM
EXPOSITION PARK

C. Fred Gehring, *Acting Director*

BOARD OF GOVERNORS

Mr. Howard Robertson, President
Mr. Roger Jessup, Vice-President
Miss Irene Tillinghast, Secretary
Mrs. Fred H. Bixby
Mrs. Mabel Otis Booth
Dr. Owen C. Coy
Mr. John J. Garland
Mr. Samuel M. Haskins
Dr. Rockwell D. Hunt
Dr. Rufus B. von KleinSmid
Miss B. Mabury
Mr. George R. Martin
Mr. Harvey S. Mudd
Mr. J. R. Pemberton
Mr. Albert B. Ruddock
Mr. Wm. H. Schuchardt

THE MUSEUM ASSOCIATES

Miss B. Mabury, President
Mr. Howard Robertson, Vice-President
Mr. Roger Jessup, Treasurer
Mrs. Mabel Otis Booth, Secretary
Mrs. Fred H. Bixby
Dr. Owen C. Coy
Mr. John J. Garland
Mr. Samuel M. Haskins
Dr. Rockwell D. Hunt
Dr. Rufus B. von KleinSmid
Mr. George R. Martin
Mr. Harvey S. Mudd
Mr. J. R. Pemberton
Mr. Albert B. Ruddock
Mr. William H. Schuchardt

THE MUSEUM ASSOCIATION EXECUTIVE COMMITTEE

Dr. Majl Ewing, President
Mr. Henry Duque, Vice-President
Mrs. Feg Murray, Vice-President
Mr. Robert Balzer, Vice-President
Miss Louise Upton, Secretary
Mr. Larry Lewin, Recording Secretary
Mrs. W. Jarvis Barlow
Dr. Mars Baumgardt
Mrs. George S. Behrendt
Dr. John Caughey
Miss Lucy Clark
Mrs. J. H. Comby
Mr. Walt Disney
Mrs. Majl Ewing
Mr. John Anson Ford
Mrs. Harold Grieve
Mrs. Wm. Preston Harrison
Mrs. A. W. Hood
Dr. Robert Kennicott
Mrs. Roland T. Kinney
Mrs. Rudolf Liebig
Mrs. Claude McFadden
Mrs. Roland J. McKinney
Miss Anne Mumford
Mr. Howard Hunt Pattee
Mrs. Elizabeth B. Peeler
Mr. John Henry Russell
Mr. Sumner Spaulding
Mrs. Lewis A. Weiss
Mrs. J. Perry Wood

THE MUSEUM ASSOCIATION

The Museum Association, authorized by the Museum Associates to enable our citizens to become more closely allied with the Los Angeles County Museum and cooperate with its programs and development, at present numbers 472 members. The annual membership dues provide purchase funds for additions to the collections of the Museum, for the publication of the Museum Quarterly, for expenses incidental to the various affairs sponsored by the Association. When new exhibitions are opened, the Association has planned significant premieres and social affairs for its members. Musicales, lectures on history, science, and art, and Museum tours are a regular part of the program. Members of the Association are sent invitations to all Museum previews of outstanding exhibitions, a subscription to the Museum Quarterly, notices of special events, and have an opportunity to meet the leaders of the community who are bound by a common interest in the Arts and Sciences.

Patron's Membership	$ 5.00	Benefactor's Membership	$ 100.00
Sustaining Membership	10.00	Contributing Membership	1000.00

NEW MEMBERS OF THE MUSEUM ASSOCIATION SINCE JANUARY 1st, 1946

*Bennett, Cornelia
Burch, Mr. and Mrs. John Q.
*Burton, Martha S.
*Chandler, Mr. and Mrs. Norman
Comstock, Dr. John A.
Everest, Herbert A.
Everest, Jane
Farrell, Mrs. Howard
Grant, U. S.
Groves, Eleanor
Harrison, Ed N.
*Henley, Dorothy M.
*Jones, Mr. and Mrs. Rollins
*Kellogg, Elena Scripps
Kline, Dr. Fred
Pierce, Dr. W. Dwight
Rathbone, Mrs. Robert
*Rosecrans, Mr. and Mrs. W. S.
Stewart, Mrs. Patricia R.
Stultz, Mrs. O. M.
Trotti, Mrs. Lamar
Wylde, Mr. and Mrs. Henry Anson

*Sustaining memberships.

SCHEDULE OF EXHIBITIONS

HISTORY DIVISION

Reinstalled South Seas Exhibit ..... Opens April 1

SCIENCE DIVISION

5th Annual Exhibition, Lapidary Society ..... May 4-June 30

ART DIVISION

Paintings by Leland Curtis ..... Through April 21
Personal Possessions of Franklin D. Roosevelt ..... Through April
Paintings of Paris, for Life Magazine, by Floyd and Gladys Rockmore Davis ..... April 10-29
Photographs by Hy Hirsh ..... May 1-June 2
California Flower Studies by Sidney Armer ..... Through May 9
Paintings by Marsden Hartley ..... May 12-June 13
100 Treasures from the Museum Art Collections ..... Through May 22
7th Annual Exhibition, Artists of Los Angeles and Vicinity ..... June 2-July 14
Paintings by Max Weber ..... June 16-July 18
Paintings and Craftswork, Art Teachers of Southern California ..... July 7-August 4

DECORATIVE ARTS

16th-18th Century Textiles from the Museum Collections ..... Opens April 27

NATURAL HISTORY

New Habitat Groups, the Grizzly Bear and Desert Mountain Sheep ..... Permanent

LECTURES AND MUSIC

The 1945-6 season of diversified lectures, given in the Lecture Hall at 3:00 o'clock each Sunday afternoon, continues through June 9.

The current series of programs by the Los Angeles Music Teachers Association, third Sunday of the month at 2:00 o'clock, continues on April 21 and May 19.

Both activities, arranged through the Division of Education, suspend for the summer but will be resumed in the fall.

MUSEUM VISITING HOURS

Changed in April

Sundays, Mondays, and Holidays ..... 1 to 5 P.M.
Tuesdays through Saturdays ..... 10 A.M. to 5 P.M.